<u>**REMARKS**</u>

Claims 1-21 are currently pending in the subject application and are presently under consideration. Claims 1, 4, 6, 8-10, and 12-21 have been amended as shown on pp. 8-14 of the Reply. Claim 7 has been cancelled without prejudice or disclaimer. In addition, the specification has been amended as indicated on pp. 2-7.

Applicants' representative thanks the Examiner for the courtesies extended during the telephonic interview on March 6, 2007, between Examiners Dorothy S. Siedler and Talivaldis I. Smits and applicants' representative Bradley D. Spitz. During the interview, applicants' representative argued in response to the Examiner's rejection of the claims under 35 U.S.C. §101 that said claims produce a useful, concrete, and tangible result. Further, applicants' representative argued in response to the Examiner's rejection of claims 4 and 7-10 under 35 U.S.C. §103 that it would not have been obvious to one of ordinary skill in the art to combine the teachings of the cited references. In conjunction with these arguments, proposed amendments to the claims were discussed.

Favorable reconsideration of the subject patent application is respectfully requested in view of the comments and amendments herein.

I.   **Objection to the Specification**

The Specification is objected to because of grammatical and spelling errors noted by the Examiner. Applicants' representative has reviewed the specification and claims and has amended the specification as well as claims 6, 14, and 17 to remove all such errors. Accordingly, applicants' representative respectfully requests that this objection be withdrawn.

II.   **Objection to the Information Disclosure Statement**

The Information Disclosure Statement is objected to for failing to provide a legible copy of each cited non-patent literature publication. Applicants' representative has provided legible copies of each non-patent literature publication cited in the Information Disclosure Statement (along with the required statement/fee) with this reply. Accordingly, applicants' representative respectfully requests that this objection be withdrawn. Nevertheless, substitute copies of such references are submitted herewith.

III.   Objection to Claims 4, 9, 10, 16 and 18

Claims 4, 9, 10, 16 and 18 are objected to for using variables which are not defined. Applicants' representative has amended the aforementioned claims to define all previously undefined variables. Accordingly, applicants' representative respectfully requests that this objection be withdrawn.

IV.   Rejection of Claim 10 Under 35 U.S.C. §112

Claim 10 stands rejected under 35 U.S.C. §112 for failing to comply with the written description requirement. Specifically, the Examiner contends that claim 10 uses the variable B_s, which was not defined in either the claims or the specification, and therefore said claim contains subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventors, at the time the application was filed, had possession of the claimed invention. Withdrawal of this rejection is requested for at least the following reasons.

The probability distributions in claim 10 are as follows:

$$p(s_n = s \mid s_{n-1} = s') = \pi_{s's},$$

$$p(x_n \mid s_n = s, x_{n-1}) = N(x_n \mid A_s x_{n-1} + a_s, B_s),$$

$$p(y_n \mid s_n = s, x_n) = N(y_n \mid C_s x_n + c_s, D_s),$$

The third of the probability distributions illustrates a mapping from x to y. The variables C and c are the parameters for mapping from x to y, and the variable D represents the covariance matrix of the residual vector after the mapping from x to y. Similarly, the second of said probability distributions illustrates a mapping from the state of x at a given frame to the state of x at the following frame. In a similar fashion, the variables A and a are the parameters for mapping from a state of x at a given frame to a state of x at the immediately following frame, and the variable B represents the covariance matrix of the residual vector after said mapping. The definitions of the variables A, a, and B are conveyed to one of ordinary skill in the art through the nature of the claimed probability distributions and the given definitions of the variables C, c, and D. Accordingly, withdrawal of this rejection is respectfully requested.

V.   Rejection of Claims 1-20 Under 35 U.S.C. §101

Claims 1-20 stand rejected under 35 U.S.C. §101 because the claimed invention is directed to non-statutory subject matter. Withdrawal of this rejection is requested for at least the following reasons.

Amended independent claim 1 (and its corresponding independent claims) recites: *A system that facilitates modeling speech dynamics, comprising: an input component that receives acoustic data; and **a model component that employs the acoustic data to characterize speech**, the model component comprising model parameters that form a mapping relationship from unobserved speech dynamics to observed speech acoustics, the model parameters are employed to decode an unobserved phone sequence of speech based, at least in part, upon a variational learning technique, wherein the model component is based, at least in part, upon a hidden dynamic model in the form of a segmental switching state space model.*

On page 4 of the Office Action, the Examiner interprets "an input component" and "a model component" as being software components within a larger computer program. Thus, the Examiner asserts that claim 1 is directed to unpatentable subject matter because said claim recites an abstract idea or functional descriptive material with no provided practical application. Applicants' representative respectfully disagrees and submits that the Examiner is misconstruing the requirements necessary to fulfill the conditions for patentability under 35 U.S.C. §101.

> Because the claimed process applies the Boolean principle [abstract idea] ***to produce a useful, concrete, tangible result*** ... on its face the claimed process comfortably falls within the scope of §101. *AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352, 1358. (Fed. Cir. 1999) (emphasis added); *see State Street Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 1373, 47 U.S.P.Q. 2d 1596, 1601 (Fed. Cir. 1998). The inquiry into patentability requires an examination of the contested claims to see if the claimed subject matter, as a whole, is a disembodied mathematical concept representing nothing more than a "law of nature" or an "abstract idea," or if the mathematical concept has been ***reduced to some practical application rendering it "useful."*** *AT&T*, 172 F.3d at 1357

(citing *In re Alappat*, 33 F.3d 1526, 1544, 31 U.S.P.Q. 2d
(BNA) 1545, 1557 (Fed. Cir. 1994)) (emphasis added).

According to *AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352 (Fed.
Cir. 1999), the legal standard set forth by the Federal Circuit for determining whether
claims are directed to statutory subject matter is whether the claims can be applied in a
practical application to produce a useful, concrete and tangible result. Further, the fact
that a claim is directed to software code does not change this legal standard. In *Eolas
Techs., Inc. v. Microsoft Corp.*, 399 F.3d 1325 (Fed. Cir. 2005), the Federal Circuit held
that software code can be patentable subject matter:

> Title 35, section 101, explains that an invention includes
> "any new and useful process, machine, manufacture or
> composition of matter. . . ." Without question, *software
> code alone qualifies as an invention eligible for patenting
> under these categories*, at least as processes. *Id*. at 1338
> (emphasis added).

As written, amended independent claim 1 clearly satisfies the legal standard given
by *AT&T*. More specifically, independent claim 1 is directed to a system that creates a
speech model from acoustic data. Such a system can be applied to a broad range of
practical applications in the speech recognition field, such as dictation, interactive voice
response, and hands-free computing. These applications all clearly all provide a useful,
concrete, and tangible result. For example, a dictation application can create documents
corresponding to speech input; an interactive voice response system can facilitate
navigation of menus *via* voice commands; and a hands-free computing application allows
a user to operate his or her computer using only a microphone and his or her voice as an
input device. Therefore, it follows that the system recited by independent claim 1 can be
applied in practical applications to produce a useful, tangible, and concrete result as
required by *AT&T*.

Similarly, independent claims 12, 14, and 17 are directed to processes for
modeling speech from acoustic data. Accordingly, applicants' representative submits that
these claims also recite subject matter that can be applied in a practical application to
produce a useful, concrete, and tangible result for the reasons set forth above.

Amended independent claim 19 recites: *A data packet transmitted between two or more computer components that facilitates modeling of speech dynamics, the data packet comprising: a data structure associated with one or more recovered speech parameters; and* **a segmental switching state space speech model that employs acoustic data and the one or more recovered speech parameters to facilitate modeling of speech dynamics**, *the recovered speech parameters including at least one articulation parameter and at least one duration parameter.* Thus, claim 19 pertains to software code comprising a speech model that employs acoustic data and recovered speech parameters to facilitate the modeling of speech dynamics. This software code is encapsulated in a data packet along with the recovered speech parameters and transmitted from one computer process to another computer process so that the speech model contained therein can be employed to facilitate the modeling of speech dynamics. The fact that a data packet encases the software code is irrelevant to the fact that it is software code that is contained therein. Instead, applicant's representative submits that the relevant inquiry under 35 U.S.C. §101 is whether the software code within the data packet produces a useful, concrete and tangible result. The software code within the data packet recited in independent claim 19 can be utilized in the same practical applications to generate the same useful, concrete, and tangible results as those discussed for the system recited by independent claim 1. Accordingly, applicants' representative submits that independent claim 19 also recites subject matter that can be applied in a practical application to produce a useful, concrete, and tangible result for the reasons set forth above.

Amended independent claim 20 recites *a computer readable medium containing computer executable instructions operable to perform a method of modeling speech dynamics.* Thus, independent claim 20 now recites a computer-readable medium encoded with a computer program. Because a computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, this claim recites statutory subject matter under 35 U.S.C. §101. MPEP 2106.01. In view of the foregoing, applicants' representative respectfully requests that this rejection be withdrawn.

VI.   Rejection of Claims 1-3, 5, 11-13, 19-21 Under 35 U.S.C. §102(b)

Claims 1-3, 5, 11-13, 19-21 stand rejected under 35 U.S.C. §102(b) as being anticipated by Hogden (US 6,052,662). This rejection should be withdrawn for at least the following reasons. The cited reference does not disclose or suggest all features recited in the subject claims as amended.

> For a prior art reference to anticipate, 35 U.S.C. §102 requires that "*each and every element* as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950 (Fed. Cir. 1999) (*quoting Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987)) (emphasis added).

Independent claim 1 (and its corresponding dependent claims) has been amended to incorporate limitations previously found in dependent claim 7. Claim 7 has been cancelled herein without prejudice or disclaimer. Amended independent claim 1 recites: *A system that facilitates modeling speech dynamics, comprising: an input component that receives acoustic data; and a model component that employs the acoustic data to characterize speech, the model component comprising model parameters that form a mapping relationship from unobserved speech dynamics to observed speech acoustics, the model parameters are employed to decode an unobserved phone sequence of speech based, at least in part, upon a variational learning technique, **wherein the model component is based, at least in part, upon a hidden dynamic model in the form of a segmental switching state space model***.

Hogden relates to a speech processing methodology called Maximum Likelihood Continuity Mapping (Malcom), which models acoustic speech data as a continuous pseudo-articular path. (*See, e.g.,* col. 5, ll. 10-13). Malcom determines a pseudo-articular path for a given set of acoustic speech data by finding the pseudo-articular path that would be most likely to produce the acoustic speech data. (*See, e.g.,* col. 8, ll. 31-37). However, amended claim 1 recites that *the model component is based, at least in part, upon a hidden dynamic model in the form of a segmental switching state space model.* Hogden is silent as to a speech model in the form of a segmental switching state space

model. In fact, the Examiner concedes on page 12 of the Office Action that Hogden does not disclose such a model.

Claims 12, 19, 20, and 21 have been amended in a similar manner to independent claim 1 above. Thus, Hogden does not disclose or suggest all features of said claims for the reasons stated above. In view of the foregoing, Hogden does not disclose or suggest all features recited in the subject claims. Accordingly, Applicant's representative respectfully requests that this rejection be withdrawn.

VII.   Rejection of Claims 6, 17 and 18 Under 35 U.S.C. §103(a)

Claims 6, 17 and 18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hogden in view of McDonough (US 5,652,748). This rejection should be withdrawn for at least the following reasons.

With regard to claim 6, applicants' representative notes that independent claim 1, from which this claim depends, has been amended to recite features not disclosed or suggested by Hogden. Further, McDonough does not cure the deficiencies of Hogden with regard to independent claim 1. Thus, Hogden and McDonough, either alone or in combination, do not teach or suggest all limitations of claim 6.

In addition, independent claim 17 (and, correspondingly, dependent claim 18) has been amended in a similar manner to independent claim 1 to include a segmental switching state space model, which is not disclosed or suggested by Hogden. Accordingly, Hogden and McDonough, either alone or in combination, do not teach or suggest all limitations of claim 17 or 18. In view of the foregoing, applicants' representative respectfully requests that this rejection be withdrawn.

VIII.   Rejection of Claims 4, 7-10 Under 35 U.S.C. §103(a)

Claims 4, 7-10 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hogden in view of Ghahramani *et al.*, "Variational Learning for Switching State-Space Models", Neural Computation 2000. This rejection should be withdrawn for at least the following reasons. There is no suggestion or motivation to combine the teachings of the cited references.

> To reject claims in an application under §103, an examiner must establish a *prima facie* case of obviousness. A *prima facie* case of obviousness is established by a showing of three basic criteria. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *See* MPEP §706.02(j). The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. *See In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

As noted *supra*, independent claim 1 has been amended to incorporate limitations previously found in dependent claim 7. Specifically, independent claim 1 recites that *the model component is based, at least in part, upon a hidden dynamic model in the form of a segmental switching state space model*. Dependent claim 7 has herein been cancelled without prejudice or disclaimer. Accordingly, the rejection is moot with regard to claim 7 and withdrawal of the rejection with regard to said claim is requested notwithstanding applicants' representative's disagreement with the rejection. However, because the limitations of dependent claim 7 have been incorporated into independent claim 1, a discussion of the rejection as applied to dependent claim 7 follows with regard to amended independent claim 1.

Hogden, as stated *supra*, relates to a speech processing methodology called Maximum Likelihood Continuity Mapping (Malcom). (*See, e.g.,* col. 5, ll. 10-13). As conceded by the Examiner and further noted *supra*, Hogden is silent as to a speech model in the form of a segmental switching state space model. To overcome this deficiency of Hogden, the Examiner cites Ghahramani *et al.* This reference is a mathematical primer that relates to the segmental switching state space model. (*See, e.g.,* p. 1, para. 5). In the introduction section of the reference, it is noted that the segmental switching state space model can be applied in the econometrics and signal processing fields. (*See id.*). Ghahramani *et al.* also describes two experiments using the segmental switching state space model. The first of these experiments was performed on artificial test data

generated by two state-space models. (*See* Section 5.1; p. 12, para. 6). The second of these experiments was performed on respiration force data obtained from a person with sleep apnea. (*See* Section 5.2; p. 13, para. 3).

At page 12 of the Office Action, the Examiner asserts that the speech recognition discipline is a subset of signal processing, and therefore Ghahramani *et al.* suggests that the segmental switching state space model can be used as a speech model. Based on this, the Examiner asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Hogden and Ghahramini *et al.* Applicants' representative respectfully disagrees with this assertion and submits that there is no suggestion or motivation, either explicitly or implicitly in the cited references, to combine the teachings of the cited references.

There is clearly no explicit suggestion or motivation to use the segmental switching state space model taught by Ghahramani *et al.* in a speech processing application. Although Ghahramani *et al.* discloses the use of such a model in signal processing, it does not explicitly mention *speech* processing applications. Additionally, the reference supplies no example applications of the model that are explicitly directed to *speech* processing applications.

Furthermore, Ghahramani *et al.*, taken in combination with the knowledge of one of ordinary skill in the art at the time of the claimed invention, does not implicitly suggest the use of a segmental switching state space model for speech applications. As indicated in the cited references, it is commonly known that many models used in signal processing applications, such as the hidden Markov model, can also be applied to speech processing applications. (*See, e.g.,* Hogden at col. 6, ll. 11-50). However, before such a model can be used in a speech processing application, it must be adapted to account for the nuances of speech. For example, because human speech conforms to pre-set phones, words, and phrases that make up a language, a model must take this into account by finding these phones, words, and phrases. In the case of a segmental switching state space model applied to speech applications, such as the one recited in amended independent claim 1, this is accomplished by establishing segmental constraints on the model at soft phone boundaries based on an expectation maximization framework. (*See* p. 7, ll. 26-27). In light of the adaptations necessary to use a segmental switching state space model in a

speech processing application, it would not have been obvious to one of ordinary skill in the art at the time of the claimed invention to use the segmental switching state space model disclosed in Ghahramani *et al.* for such an application.

Ghahramani et al. discloses two concrete examples of segmental constraints. These examples are illustrated by the two experiments described in the reference. In the first experiment, a segmental switching state space model receives an input signal created from two state space models. Here, the segmental switching state space model attempts to break the input signal into the segments produced by the first model and the segments produced by the second model. (*See* Section 5.1; p. 12, para. 6). In the second experiment, a segmental switching state space model attempts to break an input signal corresponding to respiration force into segments corresponding to periods of rhythmic breathing and segments corresponding to periods of apnea. (*See* Section 5.2; p. 13, para. 3). In both of these experiments, segmentation was based on input data with two well-defined states. On the other hand, a segmental switching state space model for speech data, as alluded to in the subject specification, requires segmentation based on phone boundaries. (*See* p. 7, ll. 26-27). The number of phones possible in human speech clearly far exceeds the two states on which the segmentation in the experiments described in Ghahramani *et al.* was based. Further, segmentation based on phone boundaries must account for much more subtle differences in an input data stream. These differences demonstrate that applying a segmental switching state space model to a speech application would necessarily involve significant adaptation over and beyond simply adopting and utilizing the model. Thus, one of ordinary skill in the art at the time of the claimed invention would not have been implicitly motivated or suggested to combine the cited references.

In view of the foregoing, it would not have been obvious to one of ordinary skill in the art at the time of the claimed invention to combine the teachings of the cited references. Accordingly, applicants' representative respectfully requests that this rejection be withdrawn.

IX.   Rejection of Claims 14-16 Under 35 U.S.C. §103(a)

Claims 14-16 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hogden in view of Ghahramani *et al.*, and further in view of McDonough. This rejection should be withdrawn for the following reasons. Independent claim 14 (and, correspondingly, dependent claims 15-16) recites a speech model in the form of a segmental switching state space model. Thus, it would not have been obvious to one of ordinary skill in the art at the time of the claimed invention to combine the teachings of Hogden and Ghahramani *et al.* for the reasons stated in Section VIII *supra*. Further, McDonough does not cure the noted deficiencies. Accordingly, applicants' representative respectfully requests that this rejection be withdrawn.

CONCLUSION

The present application is believed to be in condition for allowance in view of the above comments and amendments. A prompt action to such end is earnestly solicited.

In the event any fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063[MSFTP435US].

Should the Examiner believe a telephone interview would be helpful to expedite favorable prosecution, the Examiner is invited to contact applicants' undersigned representative at the telephone number below.

Respectfully submitted,
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